SPECIFICATION AMENDMENTS

Please amend the Title of the Invention as follows:

-- MULTIRESOLUTION UNSHARP IMAGE PROCESSING APPARATUS --

Please delete the paragraphs beginning at page 4, line 1 and ending at page 43, line 20.

Please add the following paragraphs after the heading "Detailed Description of the Preferred Embodiment" at page 46.

-- Accordingly, to overcome the cited shortcomings, the abovementioned objects of the present invention can be attained by image-processing apparatus described as follow.

(1) An image-processing apparatus, in which a high-frequency component signal of an original image-signal, representing a plurality of pixels, is added to either the original image-signal or a lowest frequency image-signal of the original image-signal, in order to generate a processed image-signal, comprising: a conversion-processing section to apply a conversion-processing to unsharp image-signals, generated from the original image-signal in respect to a plurality of frequency bands, so as to generate converted unsharp image-signals; a differential processing section to generate differential image-signals obtained from

differences between the unsharp image-signals and the converted unsharp image-signals; and an addition-processing section to totally add the differential image-signals to generate the high-frequency component signal of the original image-signal.

(2) The image-processing apparatus of item 1, wherein the differential image-signals derive from either differences between the unsharp image-signals in an adjacent pair of the frequency-bands or differences between the original image-signal and the converted unsharp image-signals.

(3) The image-processing apparatus of item 1, wherein the conversion-processing is to convert pixel values of the unsharp image-signals, based on a non-linear transform.

(4) The image-processing apparatus of item 1, wherein the conversion-processing is determined by the original image-signal or the unsharp image-signals in the plurality of frequency-bands.

(5) The image-processing apparatus of item 1, wherein the conversion-processing is determined by the original image-signal or the unsharp image-signals in adjacent pairs of frequency-bands.

(6) The image-processing apparatus of item 1, wherein the conversion-processing varies depending on either one of pixel value of the unsharp image-signals employed for generating the differential image-signals or pixel values of the original image-signal.

(7) The image-processing apparatus of item 1, wherein the conversion-processing varies depending on the unsharp image-signals.

(8) The image-processing apparatus of item 1, wherein the conversion-processing is a suppression-processing for suppressing an averaging-processing for averaging image-signals.

(9) The image-processing apparatus of item 1, wherein the conversion-processing varies depending on pixel values of the unsharp image-signals to be processed by the conversion-processing.

(10) The image-processing apparatus of item 1, wherein the conversion-processing varies depending on pixel values of an unsharp image-signal at a lowest frequency-band.

(11) The image-processing apparatus of item 1, wherein the conversion-processing varies depending on pixel values of the original image-signal.

(12) The image-processing apparatus of item 8, wherein the lower a frequency-band in which the unsharp image-signals reside is, the greater a degree of suppressing the averaging-action for averaging the image-signals in the suppression-processing is.

(13) The image-processing apparatus of item 8, wherein the higher a frequency-band in which the unsharp image-signals reside is, the stronger a power of suppressing the averaging-action for averaging the image-signals in the suppression-processing is.

(14) An image-processing apparatus, in which a compensation-signal generated from a low-frequency component signal of an original image-signal, representing a plurality of pixels, is added to either the original image-signal or a lowest frequency image-signal of the original image-signal, in order to generate a processed image-signal, comprising: a conversion-processing section to apply a conversion-processing to unsharp image-signals, generated from the original image-signal in respect to a plurality of frequency bands, so as to generate converted unsharp image-signals; a differential processing section to generate differential image-signals obtained from differences between the unsharp image-signals and the converted unsharp image-signals; and a compensation-signal

calculating section to totally add the differential image-signals so as to generate a high-frequency component signal, and to calculate the compensation-signal by subtracting the low-frequency component signal form a converted low-frequency component signal, which is derived from a difference between the high-frequency component signal and the original image-signal.

(15) The image-processing apparatus of item 14, wherein the differential image-signals are derived from either differences between the unsharp image-signals in adjacent pairs of the frequency-bands or differences between the original image-signal and the converted unsharp image-signals.

(16) The image-processing apparatus of item 14, wherein the conversion-processing is to convert pixel values of the unsharp image-signals, based on a non-linear transform.

(17) The image-processing apparatus of item 14, wherein the conversion-processing is determined by the original image-signal or the unsharp image-signals in the plurality of frequency-bands.

(18) The image-processing apparatus of item 14, wherein the conversion-processing is determined by the original image-signal or the unsharp image-signals in an adjacent pair of frequency-bands.

(19) The image-processing apparatus of item 14, wherein the conversion-processing varies depending on either one of pixel value of the unsharp image-signals employed for generating the differential image-signals or pixel values of the original image-signal.

(20) The image-processing apparatus of item 14, wherein the conversion-processing varies depending on the unsharp image-signals.

(21) The image-processing apparatus of item 14, wherein the conversion-processing is a suppression-processing for suppressing an averaging-processing for averaging image-signals.

(22) The image-processing apparatus of item 14, wherein the conversion-processing varies depending on pixel values of the unsharp image-signals to be processed by the conversion-processing.

(23) The image-processing apparatus of item 14, wherein the conversion-processing varies depending on pixel values of an unsharp image-signal at a lowest frequency-band.

(24) The image-processing apparatus of item 14, wherein the conversion-processing varies depending on pixel values of the original image-signal.

(25) The image-processing apparatus of item 21, wherein the lower a frequency-band in which the unsharp image-signals reside is, the greater a degree of suppressing the averaging-processing for averaging the image-signals in the suppression-processing is.

(26) The image-processing apparatus of item 21, wherein the higher a frequency-band in which the unsharp image-signals reside is, the stronger a power of suppressing the averaging-action for averaging the image-signals in the suppression-processing is.

(27) An image-processing apparatus, comprising: an unsharp image-signal generating section to generate unsharp image-signals from an original image-signal in respect to a plurality of frequency-bands; a differential processing section to generate differential image-signals from differences between the original image-signal and the unsharp image-signals, and to apply a conversion-processing to the differential image-signals so as to generate converted differential image-signals; and an addition processing section to add the converted differential image-signals to the original image-signal or a lowest frequency image-signal to generate a processed image-signal; wherein the conversion-processing varies depending on pixel values of the unsharp image-signals.

(28) The image-processing apparatus of item 27, further comprising: a compensation-signal calculating section to generate a compensation-signal which is derived from a low-frequency component signal obtained by subtracting a total sum of the converted differential image-signals from the original image-signal; wherein the addition processing section adds the compensation-signal, instead of the converted differential image-signals, to the original image-signal or the lowest frequency image-signal to generate the processed image-signal.

(29) The image-processing apparatus of item 28, wherein the differential image-signals derive from either differences between the unsharp image-signals in adjacent pairs of the frequency-bands or differences between the original image-signal and the unsharp image-signals.

(30) The image-processing apparatus of item 28, wherein the differential image-signals on which the conversion-processing depends are either anyone of image-signals utilized for obtaining the differential image-signals or both of them.

(31) The image-processing apparatus of item 28, wherein the conversion-processing applied to the differential image-signals varies depending on the differential image-signals.

(32) The image-processing apparatus of item 28, wherein the conversion-processing applied to the differential image-signals is a suppression-processing for suppressing an absolute pixel value at least at a part of image-signals.

(33) The image-processing apparatus of item 32, wherein the lower a frequency-band in which the differential image-signals reside is, the stronger a power of suppressing the absolute pixel value of the image-signals in the suppression-processing is.

(34) The image-processing apparatus of item 32, wherein the higher a frequency-band in which the differential image-signals reside is, the stronger a power of suppressing the absolute pixel value of the image-signals in the suppression-processing is.

(35) The image-processing apparatus of item 28, wherein a conversion-function is determined by designating a frequency characteristic, so as to realize a given frequency characteristic, and processing are conducted on the basis of the conversion-function.

(36) The image-processing apparatus of item 35, wherein the frequency characteristic can be changed depending on density.

(37) The image-processing apparatus of item 35, wherein the frequency characteristic can be changed depending on density of either the original image-signal or the unsharp image-signals for every differential image-signal.

(38) The image-processing apparatus of item 35, wherein sets of parameters for processing the frequency characteristic are provided in the image-processing apparatus, a kind of processing can be designated by selecting one set out of the sets of parameters.

(39) An image-processing apparatus, comprising: a filter-processing section to apply a mask-processing to an original image-signal, representing a plurality of pixels, with a mask so as to generate filtered original image-signals; an unsharp image-signal generating section to generate unsharp image-signals from the filtered original image-signals; a differential processing section to generate differential image-signals from differences between the original image-signal and the unsharp image-signals, or from differences between the unsharp image-signals themselves; and an addition processing section to add the differential image-signals to the original image-signal or a lowest frequency image-signal with respect to the original image-signal in order to generate a processed image-signal; wherein a frequency characteristic of the

processed image-signal can be varied by changing a frequency characteristic of the mask employed for the mask-processing.

(40) The image-processing apparatus of item 39, further comprising: a compensation-signal calculating section to generate a compensation-signal which is derived from a low-frequency component signal obtained by subtracting a total sum of the differential image-signals from the original image-signal; wherein the addition processing section adds the compensation-signal, instead of the differential image-signals, to the original image-signal or the lowest frequency image-signal to generate the processed image-signal.

(41) The image-processing apparatus of item 40, wherein the mask-processing is repetitions of filtering-processing with a specific filter.

(42) The image-processing apparatus of item 41, wherein the mask employed for the repetitions of filter-processing is a simple average.

(43) The image-processing apparatus of item 41, wherein the mask employed for the repetitions of filter-processing is a simple average of 2 pixels × 2 pixels.

(44) The image-processing apparatus of item 40, wherein a number of the repetitions of filter-processing designates the frequency characteristic of the processed image-signal.

(45) The image-processing apparatus of item 40, wherein the frequency characteristic of the processed image-signal is specified by designating weight of the mask with variance values of a normal distribution, and a number of the repetitions of filter-processing, which is approximate to the variance values of the normal distribution, is calculated to process image-signals.

(46) The image-processing apparatus of item 40, wherein the mask-processing varies depending on the unsharp image-signals.

(47) The image-processing apparatus of item 40, wherein the mask-processing varies depending on the original image-signal.

(48) The image-processing apparatus of item 40, wherein the mask-processing varies depending on a frequency characteristic of the original image-signal.

(49) An image-processing apparatus, comprising: an unsharp image-signal generating section that employs a pyramid algorithm to generate a plurality of unsharp image-signals, resolutions of which are different relative to each other, from a original image-signal representing a plurality of

pixels; a differential processing section to generate differential image-signals from differences between the original image-signal and the unsharp image-signals, or from differences between the unsharp image-signals themselves; and an addition processing section to add the differential image-signals to the original image-signal or a lowest frequency image-signal with respect to the original image-signal in order to generate a processed image-signal; wherein a frequency characteristic of the processed image-signal can be varied by changing an interpolation-processing method for adding or subtracting the unsharp image-signals.

(50) The image-processing apparatus of item 49, further comprising: a compensation-signal calculating section to generate a compensation-signal which is derived from a low-frequency component signal obtained by subtracting a total sum of the differential image-signals from the original image-signal; wherein the addition processing section adds the compensation-signal, instead of the differential image-signals, to the original image-signal or the lowest frequency image-signal to generate the processed image-signal.

(51) The image-processing apparatus of item 50, wherein the interpolation-processing is repetitions of filter-processing with a specific filter.

(52) The image-processing apparatus of item 51, wherein a mask employed for the repetitions of filter-processing is a simple average.

(53) The image-processing apparatus of item 51, wherein a mask employed for the repetitions of filter-processing is a simple average of 2 pixels × 2 pixels.

(54) The image-processing apparatus of item 50, wherein a number of the repetitions of filter-processing designates the frequency characteristic of the processed image-signal.

(55) The image-processing apparatus of item 50, wherein the interpolation-processing is performed on the basis of a sampling function of the original image-signal.

(56) The image-processing apparatus of item 50, wherein the interpolation-processing is a linear-interpolation processing.

(57) The image-processing apparatus of item 50, wherein the interpolation-processing is a spline-interpolation processing.

(58) The image-processing apparatus of item 50, wherein the interpolation-processing varies depending on a frequency band of an interpolated image-signal.

(59) The image-processing apparatus of item 50, wherein the interpolation-processing varies depending on the original image-signal.

(60) The image-processing apparatus of item 50, wherein the interpolation-processing varies depending on a frequency characteristic of the original image-signal.

(61) An image-processing apparatus, comprising: an unsharp image-signal generating section that employs a pyramid algorithm to generate a plurality of unsharp image-signals, resolutions of which are different relative to each other, from a original image-signal representing a plurality of pixels; a differential processing section to generate differential image-signals from differences between the original image-signal and the unsharp image-signals, or from differences between the unsharp image-signals themselves; and an addition processing section to add the differential image-signals to the original image-signal or a lowest frequency image-signal with respect to the original image-signal in order to generate a processed image-signal; wherein a mask-processing is employed for generating the unsharp image-signals in a process of the pyramid algorithm, and a reduction rate of the unsharp image signals, caused by a down sampling processing, varies depending on a frequency characteristic of a mask.

(62) The image-processing apparatus of item 61, further comprising: a compensation-signal calculating section to generate a compensation-signal which is derived from a low-frequency component signal obtained by subtracting a total sum of the differential image-signals from the original image-signal; wherein the addition processing section adds the compensation-signal, instead of the differential image-signals, to the original image-signal or the lowest frequency image-signal to generate the processed image-signal.

(63) The image-processing apparatus of item 62, wherein the mask-processing is repetitions of filter-processing with a specific filter.

(64) The image-processing apparatus of item 62, wherein the mask employed for the repetitions of filter-processing is a simple average.

(65) The image-processing apparatus of item 62, wherein the mask employed for the repetitions of filter-processing is a simple average of 2 pixels × 2 pixels.

(66) The image-processing apparatus of item 62, wherein the mask-processing varies depending on the unsharp image-signals.

(67) The image-processing apparatus of item 62, wherein the mask-processing varies depending on the original image-signal.

(68) The image-processing apparatus of item 62, wherein the mask-processing varies depending on a frequency characteristic of an original image-signal.

(69) The image-processing apparatus of item 62, wherein a variation of the frequency characteristic of the mask or a change of an interpolation-processing is determined by designating a frequency characteristic.

(70) The image-processing apparatus of item 69, wherein the designated frequency characteristic can be changed depending on a density of the original image-signal or the unsharp image-signals.

(71) The image-processing apparatus of item 69, wherein the designated frequency characteristic can be changed depending on a density of the original image-signal or the unsharp image-signals for each of the unsharp image-signals and the differential image-signals.

(72) The image-processing apparatus of item 39, wherein sets of parameters for processing the frequency characteristic are provided in the image-processing apparatus, a kind of processing can be designated by selecting one set out of the sets of parameters.

(73) An image-processing apparatus, comprising: an unsharp image-signal generating section to generate a plurality of unsharp image-signals from a original image-signal, representing a plurality of pixels; a differential processing section to generate differential image-signals from the unsharp image-signals or the original image-signal; and an addition processing section to add the differential image-signals to the original image-signal or a lowest frequency image-signal with respect to the original image-signal in order to generate a processed image-signal; wherein repetitions of filter-processing with a specific filter are conducted for generating the unsharp image-signals.

(74) The image-processing apparatus of item 73, further comprising: a compensation-signal calculating section to generate a compensation-signal which is derived from a low-frequency component signal obtained by subtracting a total sum of the differential image-signals from the original image-signal; wherein the addition processing section adds the compensation-signal, instead of the differential image-signals, to the original image-signal or the lowest frequency image-signal to generate the processed image-signal.

(75) The image-processing apparatus of item 73, wherein a mask employed for the repetitions of filter-processing is a simple average.

(76) The image-processing apparatus of item 73, wherein a mask employed for the repetitions of filter-processing is a simple average of 2 pixels × 2 pixels.

(77) The image-processing apparatus of item 73, wherein a mask-processing varies depending on the unsharp image-signals.

(78) The image-processing apparatus of item 73, wherein a mask-processing varies depending on the original image-signal.

(79) The image-processing apparatus of item 73, wherein a mask-processing varies depending on a frequency characteristic of the original image-signal.

(80) The image-processing apparatus of item 76, wherein a number of repetitions of the single average of 2 pixels × 2 pixels is not less than 16.

(81) The image-processing apparatus of item 76, wherein a number of repetitions of the single average of 2 pixels × 2 pixels is not less than 8.

Further, to overcome the abovementioned problems, other image-processing apparatus, embodied in the present invention, will be described as follow:

(82) The image processing apparatus that obtains a processed image signal by adding a high-frequency component signal of an original image signal for said original image signal comprising multiple pixels to said original image signal or a lowest frequency image signal said original signal, wherein said high-frequency component signal is obtained that by adding a differential image signal obtained by applying conversion processing to unsharp image signals of multiple frequency bands that are generated from said original image signal and adding a difference between said unsharp image signal and said converted image signal.

By applying this configuration, a differential image signal that is added to an original image signal is adjusted by converting an unsharp image signal and, consequently, a processing image signal can be created with controlling noise and artifacts together with an edge emphasis.

(83) The image processing apparatus, wherein said differential image signals derive from either differences between said unsharp image signals in adjacent pairs of frequency bands or differences between said original image signal and said converted unsharp image signals.

By applying this configuration, frequency band overlapping sections of differential image signals are reduced by taking differences between adjacent pairs of unsharp image

signals and by applying conversion processing to said unsharp image signals, operation in band units is enabled.

(84) The image processing apparatus, wherein said conversion processing applied to said unsharp image signals of said multiple frequency bands converts pixel values of said original image signals of said unsharp image signals based on non-linear conversion.

By applying this configuration, edge emphasis and control of noise and artifacts are enabled by performing non-linear conversion.

(85) The image processing apparatus, wherein conversion processing that is applied to unsharp image signals of said multiple frequency bands is determined by said original image signal or said unsharp image signals of said multiple frequency band.

By applying this configuration, processing depending on an unsharp tendency of image signals can be performed, and consequently, effective edge emphasis and noise and artifacts control are enabled.

(86) The image processing apparatus, wherein said conversion processing applied to said unsharp image signals of said multiple frequency bands is determined by said unsharp image signals in adjacent-pairs of frequency bands or said original image signal.

By applying this configuration, processing depending on an unsharp tendency of image signals can be performed, and consequently, effective edge emphasis and noise and artifacts control are enabled.

(87) The image processing apparatus, wherein said conversion processing that is applied to said unsharp image signals of said multiple frequency bands varies according to a pixel value of either one of said unsharp image signals or said original unsharp image signal that is used for generating said differential image signals.

By applying this configuration, processing depending on pixels prior to unsharp processing can be performed, enabling conversion with more consideration to high frequency component signals, and consequently, more effective edge emphasis and control of artifacts and noise are enabled.

(88) The image processing apparatus, wherein said conversion processing that is applied to said unsharp image signals of said multiple frequency bands vary according to said unsharp image signals.

By applying this configuration, adjustments depending on frequency bands can be made and more effective edge emphasis and control of noise and artifacts are enabled.

(89) The image processing apparatus, wherein said conversion processing that is applied to said unsharp image signals control averaging of image signals.

By applying this configuration, unsharpness is controlled in a high contrast section, which is a cause of overshoot/undershoot and consequently, effective edge emphasis and control of noise and artifacts are enabled.

(90) The image process apparatus, wherein said conversion processing that is applied varies depending on pixel values of said unsharp image signals to be processed by said conversion processing.

By applying this configuration, processing depending on signal values of unsharp image signals become possible and by enhancing control of artifacts of signals with noticeable noise signal (density), more effective edge emphasis and control of noise and artifacts are enabled.

(91) The image processing apparatus, wherein said conversion processing that is applied to said unsharp image signals varies depending on pixel values of said unsharp images at lowest frequency band.

By applying this configuration, changes of conversion of unsharp image signals may follow a major configuration of an original image signal.

(92) The image processing apparatus wherein said conversion processing that is applied to said unsharp image signals varies depending on pixel values of said original signal.

By applying this configuration, changes of conversion of unsharp images may follow an original image signal faithfully.

(93) The image processing apparatus, wherein a degree of averaging control of said conversion processing that is applied to said unsharp image signals increases as frequency bands of said unsharp images become lower.

By applying this configuration, a degree of compensation increases as frequency bands become lower and consequently, image signals of higher quality may be obtained.

(94) The image processing apparatus, wherein a degree of averaging control of said conversion processing that is applied to said unsharp image signals increases as frequency bands of said unsharp image signals become higher.

By applying this configuration, averaging control increases for high frequency component signals that tend to contain many noise component signals and consequently effective edge emphasis and control of noise and artifacts are enabled.

(95) The image processing apparatus that obtains processed image signals by adding compensation signals that are obtained from low frequency component signals of an original signal to said original signal or a low frequency image signal comprising multiple pixels, wherein said compensation signals are obtained by applying conversion processing to unsharp image signals of multiple frequency bands that are generated from said original signal, generating high-frequency image signals that are obtained adding differential image signals that are obtained by differences between said unsharp image signals and said image signals generated after said conversion processing, and obtaining differences of said low frequency image signals from results of conversion of low frequency image signals that are obtained from differences between said high frequency image signals and said original image signal.

By applying this configuration, a compensation section that is added to an original image signal or super low frequency image signal, processing image signals can be generated by applying both image signal dynamic range compression and control of noise and artifacts.

(96) The image processing apparatus that obtains processed image signals by generating unsharp image signals of multiple frequency bands for an original image signal consisting of multiple pixels, applying conversion processing to differential image signals of said unsharp image signals, and adding to an original image signal or lowest frequency image signals, or adding a compensation signal that is calculated from a low frequency component signal that is obtained from a difference between said original image signal and a result of multiplication of a differential signal after said conversion processing to an original image processing or a lowest frequency image processing, wherein said conversion processing varies depending on pixel values of said unsharp image signals.

By applying this configuration, emphasis of bands containing many noises in signal areas where noises are noticeable can be controlled by adjusting differential image signals that are added to an original image signal or lowest frequency band image signals, depending on signal values of unsharp images and consequently, more effective edge emphasis and control of noise and artifacts are enabled.

(97) The image processing apparatus, wherein said differential image signal indicate a difference between unsharp image signals of a pair of adjacent frequency bands or a difference between an original image signal and a converted unsharp image signal.

By applying this configuration, a frequency band overlapping section of each differential signal is reduced by determining a difference between a pair of adjacent image signals and operation by band units is enabled by matching conversion processing to unsharp image signals.

(98) The image processing apparatus, wherein said unsharp image signal on which said conversion processing depends is an image signal of either of both of said image signals used when said differential signals were obtained.

By applying this configuration, an unsharp image signal of an image size identical to a converted image signal can be used when a pyramid algorithm is used also and consequently, processing can be simplified.

(99) The image processing apparatus, wherein conversion processing that is applied to said multiple differential image signals varies depending on said differential image signals.

By applying this configuration, adjustments depending on frequency bands are enabled and consequently more effective edge emphasis and control of noise and artifacts are enabled.

(100) The image processing apparatus, wherein conversion processing that is applied to said differential image signals controls absolute values of pixel values in at least some image signals.

By applying this configuration, emphasis on a high contrast section, which is a cause of overshoot/undershoot is controlled and consequently, more effective edge emphasis and control of noise and artifacts are enabled.

(101) The image processing apparatus, wherein control of absolute values of image signals by conversion processing that is applied to said differential image signals increases as frequency bands of said differential image signals become lower.

By applying this configuration, the lower the frequency band in the differential image signal, the greater the control of the absolute value becomes, enabling generation of sharper image signals with control of noise and artifacts more effectively.

(102) The image processing apparatus, wherein control of absolute values of image signals by conversion processing that is applied to said differential image signals increase as frequency bands of said differential image signals become higher.

By applying this configuration, control over absolute values increases as a frequency section that tends to contain many noise component signals becomes high and consequently, more effective edge emphasis and control of noise and artifacts are enabled.

(103) The image processing apparatus, wherein a conversion function that actualizes given frequency characteristics is determined by specifying frequency characteristics and processing is performed by said conversion function that was determined.

By applying this configuration, users only need to specify required frequency characteristics without having to be aware of various parameters to be set and consequently, processing is simplified.

(104) The image processing apparatus, wherein specification of said frequency characteristics can be changed according to a density.

By applying this configuration, users can easily specify processing depending on signal values such as control of noise emphasis by operating frequency characteristics of signal areas containing noticeable noise.

(105) The image processing apparatus, wherein specification of said frequency characteristics can be changed depending on a density for each of unsharp image signals or differential image signals.

By applying this configuration, users can easily set an intensity of processing depending on signal values for each frequency band.

(106) The image processing apparatus, wherein a set of parameters is specified in said frequency characteristic processing and processing can be specified by selecting said set of parameters.

The image processing apparatus, wherein users can select an optimum parameter set easily without manipulating many parameters.

(107) The image processing apparatus that obtains processed image signals by generating multiple unsharp image signals for an original image signal consisting of multiple pixels and adding compensation signals that are obtained by adding a differential signal between said original image signal and said unsharp image signal or a differential image

signal between said unsharp image signal and another said unsharp image signal to said original image signal or a lowest frequency image signal for said original image signal or calculating a difference of a result of multiplication of said differential image signal, to said original image signal or said lowest frequency image signal, wherein frequency characteristics of processing image signals are changed by changing mask frequencies used for mask processing for generating said unsharp image signals.

By applying this configuration, more delicate frequency characteristic adjustments are enabled for processing images by changing mask frequency characteristics.

(108) The image processing apparatus, wherein said mask processing is specific filter repetition processing.

By applying this configuration, frequency characteristics can be adjusted at high speed without using multiple filters.

(109) The image processing apparatus, wherein a mask of said repetition processing is a simple average.

By applying this configuration, frequency characteristics can be adjusted at high speed.

(110) The image processing apparatus, wherein a mask of said repetition processing is a simple average of 2 pixels × pixels.

By applying this configuration, unsharp image signals can be generated at high speed and also according to normal distribution.

(111) The image processing apparatus, wherein frequency characteristics of said processing image signals are specified by a processing repetition count of said repetition processing.

By applying this configuration, frequency characteristics can be specified easily.

(112) The image processing apparatus, wherein frequency characteristics of said processing image signals are specified by designating a weight of a mask at generation of unsharp image signals using a variance value of normal distribution and processing is performed by calculating said mask processing repetition count approximating with normal distribution of said variance value that was specified.

By applying this configuration, frequency characteristics can be specified easily.

(113) The image processing apparatus, wherein said mask processing varies depending on said unsharp image signal.

By applying this configuration, frequency characteristics may be adjusted according to a frequency band.

(114) The image processing apparatus, wherein said mask processing varies depending on an original image signal.

By applying this configuration, frequency characteristics may be adjusted according to a type of an original image signal, for instance, body parts to be examined.

(115) The image processing apparatus, wherein said masking processing varies depending on frequency characteristics of said original image signal.

By applying this configuration, adjustments according to frequency characteristics of an original image signal are enabled for controlling frequency bands with excessive noise.

(116) The image processing apparatus that obtains processed image signals by generating multiple unsharp image signals of different resolutions using a pyramid algorithm for an original image signal consisting of multiple pixels and adding a differential image signal between said original image signal and said unsharp image signal or a differential signal between said unsharp image signals to an original image signal or a lowest frequency image signal, or adding a compensation signal obtained by calculating a difference of a result of adding or sum of

said differential image signals to an original image signal or a lowest frequency image signal, wherein frequency characteristics of image processing signals are changed by a changing interpolation-processing method for addition or subtraction of said image signals of different resolutions.

By applying this configuration, more delicate frequency characteristic adjustments of processing image signals are enabled by changing frequency of interpolation-processing.

(117) The image signal apparatus, wherein said interpolation-processing is performed based on a sampling function of an original image signal.

By applying this configuration, frequency characteristics of unsharp image signals can be reproduced more faithfully.

(118) The image signal apparatus, wherein said interpolation-processing performs linear interpolation.

By applying this configuration, processing can be preformed at a high speed without making major changes in frequency characteristics of unsharp image signals.

(119) The image signal apparatus, wherein said interpolation-processing is spline interpolation.

By applying this configuration, smooth interpolation is achieved.

(120) The image signal apparatus, wherein said interpolation-processing varies depending on frequency bands of interpolation image signals.

By applying this configuration, frequency characteristics may be adjusted for each frequency band.

(121) The image signal apparatus, wherein said interpolation-processing varies depending on an original image signal.

By applying this configuration, frequency characteristics may be adjusted according to a type of an original image signal, for instance body parts examined.

(122) The image signal apparatus, wherein said interpolation-processing varies according to frequency characteristics of an original image signal.

By applying this configuration, adjustments may be made according to frequency characteristics of an original image signal such as controlling of frequency bands with many noise signals.

(123) The image signal apparatus that obtains processed image signals by generating multiple unsharp image signals of different resolutions using a pyramid algorithm for an original image signal consisting of multiple pixels and

adding a differential signal between said original image signal and said unsharp image signal or a differential image signal between two of said unsharp image signals to an original image signal or a lowest frequency image signal, or adding a compensation signal that is obtained by determining a difference of multiplication of said differential image signals to an original image signal or a lowest frequency image signal, wherein unsharp image signals are generated by mask processing through said pyramid algorithm and a reduction rate of unsharp image signals by down sampling changes according to mask frequency characteristics.

By applying this configuration, a processing speed may be increased efficiently by changing a reduction rate of image signals depend on frequency characteristics of a mask.

(124) The image processing apparatus, wherein said mask processing varies depending on unsharp image signals.

By applying this configuration, frequency characteristics may be adjusted according to a frequency band.

(125) The image processing apparatus, wherein said mask processing varies depending on an original image signal.

By applying this configuration, frequency characteristics may be adjusted according to a type of an original image, for instance, body parts examined.

(126) The image processing apparatus, wherein said mask processing varies depending on frequency characteristics of an original image signal.

By applying this configuration, adjustments may be made according to frequency characteristics of an original image signal such as controlling of frequency bands with many noise signals.

(127) The image processing apparatus, wherein changes of said frequency characteristics of a mask or changes of interpolation-processing are determined by specified frequency characteristics.

By applying this configuration, users may easily generate image signals of required frequency characteristics by determining characteristics of filters from said frequency characteristics.

(128) The image processing apparatus, wherein specification of said frequency characteristics may be changed according to a density of an original image signal or an unsharp image signal.

By applying this configuration, frequency characteristics may be adjusted effectively such as controlling of emphasis on signal areas where noise is noticeable.

(129) The image processing apparatus, wherein specification of said frequency characteristics may be changed according to a density of an original image signal or an unsharp image signal for each of said unsharp image signals or a differential image signal.

By applying this configuration, frequency characteristics may be adjusted efficiently such as controlling of emphasis of signal areas where noise is noticeable in a frequency bands containing many noise signals.

(130) The image processing apparatus that retains a set of parameters required for processing said frequency characteristics, wherein processing is specified by selecting said set of parameters.

By applying this configuration, users may achieve optimum processing by specifying a set of parameters without setting detailed parameters.

(131) The image processing apparatus that obtains processed image signals by generating multiple unsharp image signals for an original image signal consisting of multiple pixels and adding a differential image signal that is generated from said unsharp image signal or said original image signal to an original image signal or a lowest frequency image signal, or adding a compensation signal derived from a difference of multiplication of said differential image

signals to said original image signal or said lowest frequency image signal, wherein filtering processing for generating said unsharp image signals is repetition of specific filters.

By applying this configuration, processing may be simplified.

(132) The image processing apparatus, wherein a mask of said repetition processing is a simple average.

By applying this configuration, processing may be simplified and a processing speed may be increased.

(133) The image processing apparatus, wherein a mask of said repetition processing is a simple average of 2 pixels × 2 pixels.

By applying this configuration, effects equivalent to those achieved from processing by a weighting mask according to Gaussian distribution may be obtained.

(134) The image processing apparatus, wherein said mask processing varies depending on an unsharp image.

By applying this configuration, frequency characteristics may be adjusted according to a frequency band.

(135) The image processing apparatus, wherein said mask processing varies depending on an original image signal.

By applying this configuration, frequency characteristics may be adjusted according to a type of an original image, for instance, body parts examined.

(136) The image processing apparatus, wherein said mask processing varies depending on frequency characteristics of said original image signal.

By applying this configuration, processing may be varied according to frequency characteristics of an original image signal such as controlling of frequency bands containing many noise signals.

(137) The image processing apparatus, wherein a repetition count of said single average of 2 × 2 is 16 or greater.

By applying this configuration, frequency band areas contained in each unsharp image signal are reduced to about a half of frequency bands before application of mask processing, enabling disassembly to an optimum frequency band.

(138) The image processing apparatus, wherein a repetition count of said simple average of 2 × 2 is 8 or greater.

By applying this configuration, frequency bands contained in each unsharp image signal are reduced to about a half of frequency band before application of mask processing, enabling disassembly to an optimum frequency band. --

Please amend the paragraph beginning at page 48, line 3 as follows:

-- Differential processing section 12 produces a difference between the converted unsharp image signal that was obtained as described above and the original image signal, and a difference between the unsharp image signal and the converted unsharp image signal. The differential image signal that is obtained here is a difference between two unsharp image signals in a pair of adjacent frequency bands or a difference between the original image signal and the converted unsharp image signal. Addition processing section 13 obtains a high frequency component signal by adding the differential image signal that was obtained in differential processing section 12. A processed image signal can be obtained by adding the high frequency component signal to the original image signal or the lowest frequency image signal. --

Please amend the paragraph beginning at page 46, line 16 as follows:

-- In the diagram, 6 indicates a filter-processing section that applies the filtering processing, 10 indicates an unsharp image signal generating section that generates unsharp image signals after receiving output from filter processing section 6, 11 indicates a conversion processing section that applies conversion processing to unsharp image signals that were generated in unsharp image generating section, 12 indicates a differential processing section that finds a difference between an original image signal and a converted image signal and a difference between an unsharp image signal and a converted unsharp image signal, 13 indicates an addition processing section that adds differential image signals that were obtained in the differential processing section. Filter processing section 6, unsharp image generating section 10, conversion processing section 11, differential processing section 12, and addition processing section 13 can be implemented by hardware or software. Operation of the apparatus in this configuration is described below. --